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## Title page

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**Title** Hypoglycaemia and brief interventions in the emergency department - a systematic review

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## Abstract

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**Objective:** For people with diabetes, severe hypoglycaemia is the most common reason for emergency service usage and emergency department (ED) presentations. Brief interventions (BI) are a recognised intervention strategy in the ED for other conditions but to date, they have not been applied to those with hypoglycemia. This review aims to identify components and outcomes of BI for people with diabetes mellitus to inform the development of BI in the ED.

**Method:** A systematic review of randomized controlled trials was undertaken in MEDLINE, CINAHL, PsychINFO and EMBASE. Studies that examined brief interventions for people with diabetes were considered. Eligible studies were critically appraised and included in a narrative synthesis.

**Results:** A total of 2,475 citations were identified, 171 full papers were reviewed and four articles were included for review. The components 'advice' and 'assistance' from the five A Framework were the most frequently used BI components. Statistically significant improvements were achieved in psychological, functional, and satisfaction outcomes. However, clinical outcomes were not improved and economic outcomes like costs of BI were not evaluated.

**Conclusions:** The literature review demonstrated a lack of evidence related to BI in diabetes within the emergency setting despite the ED being an ideal environment. Future research needs to be conducted to investigate the effectiveness of BI for patients with diabetes.

**Manuscript**

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**INTRODUCTION**

Episodes of hypoglycaemia defined as a glucose level of 3.9 mmol/L or lower (1), are usually independently managed by the patient or their family members and friends (2). However, despite this approach, severe hypoglycaemia is the commonest reason for people with diabetes to require emergency medical assistance (2). A recently published US study estimated 97,648 annual emergency department (ED) visits for insulin-related hypoglycaemia and related hypoglycaemia errors between 2007 and 2011 and nearly one third of these patients were hospitalised (3). A similar study in England reported 101,475 hospital admissions between 2005 to 2014 for hypoglycaemia in 79,172 people with diabetes which equated to 87% of ED attendances. A quarter of all admissions resulted in a hospital stay of less than 24 hours, and a third of the admissions resulted in hospital stays of five days or longer (4). Farmer and colleagues estimated the annual cost of emergency calls for severe hypoglycaemia in England to be as high as £13.6 million (5).

Patients with severe hypoglycaemia presenting to the ED are usually medical emergencies and must be treated by healthcare professionals accordingly (2, 6) and ED nurses are key persons involved in the treatment and management of these patients. The primary goal is the rapid evaluation and stabilization of patients' blood glucose level. A secondary goal is making the patient being aware of their hypoglycaemia and the need for urgent follow-up and review with a primary care provider (7).

For patients to be able to reduce the risk of further episodes and to improve the emergency management of hypoglycaemia, patient education, including diabetes self-management education (DSME) and diabetes self-management support (DSMS), is seen as vital (2). Michie and colleagues (8) suggest that behaviour change occurs when people modify one or more of the following: capability, opportunity, and motivation relating to the behaviour. Therefore, an ED

87 encounter caused by a severe hypoglycaemic event, can provide the motivation as well as the  
88 opportunity for patients and their family members to access DSME or DSMS. The ED's  
89 environment offers a significant opportunity for educational interventions (9). Although ED  
90 healthcare professionals are often under time pressure, and resources are chronically limited,  
91 brief interventions (BI) are an encouraged strategy in this setting (9, 10) especially, relating to  
92 the above mentioned secondary goal.

93 BI is a generic term consisting of an often opportunistic, time-limited interactive encounter  
94 between a patient and a healthcare professional focusing on behaviour change (11). These short,  
95 problem-specific approaches have become an effective treatment method in patients with  
96 substance abuse problems, diet and, physical activity (12-15). BI have also become a widely  
97 available public health tool in various settings including EDs, as they can reduce high risk  
98 behaviour resulting in a reduction of ED visits and hospital admissions (13, 15, 16). However,  
99 BI is not clearly defined and reported in the literature as brief advice, brief intervention, brief  
100 counselling, short-term counselling, minimal intervention, motivational interviewing or adapted  
101 motivational interviewing (13, 14). In 2014, the National Institute for Health and Care  
102 Excellence (NICE) guidance on individual behaviour change has defined different levels of  
103 interventions; very brief, brief and extended interventions (see table 1 for the definitions) (17).

104  
105 In summary, the evidence indicates that ED is an effective and appropriate setting for the  
106 delivery of BI in specific patient situations (10, 18, 19). Our scoping review revealed no  
107 evidence relating to BI for people with diabetes presenting in ED. It therefore remains unclear  
108 how BI impacts on people with diabetes mellitus in this or other settings. Therefore, the aim of  
109 this review is to investigate and describe the characteristics and effects of BI for people with  
110 diabetes focusing on intervention components, outcomes, and target behaviours to inform the  
111 development of BI for people with diabetes in the ED experiencing hypoglycaemic episodes.

## **METHOD**

### **Design**

A systematic review of randomized controlled trials (RCTs) was carried out to meet the review aim. An inclusion and exclusion protocol was developed and PICOS applied (20). These pre-set inclusion criteria included: *Population:* adult patients with diabetes mellitus type 1 and 2. *Intervention:* very BI and BI as defined by the NICE guidelines (17) (table 1) as only these would be suitable in a ED setting, the clinical encounter has to be opportunistic and can have 1-2 follow ups; *Comparison:* studies comparing BI against usual care/standard care; *Outcome:* any benefits for patients related to their diabetes, including psychological and physical benefits. The Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) statement was followed for the conduct and reporting of this review (21).

**Table 1:** Levels of behaviour change interventions (17)

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**Very brief intervention:** A very brief intervention can take from 30 seconds to a couple of minutes. It is mainly about giving people information or directing them where to go for further help. It may also include other activities such as raising awareness of risks, or providing encouragement and support for change. It follows an 'ask, advise, assist' structure.

**Brief intervention:** A brief intervention involves oral discussion, negotiation or encouragement, with or without written or other support or follow-up. It may also involve a referral for further interventions, directing people to other options, or more intensive support. Brief interventions can be delivered by anyone who is trained in the necessary skills and knowledge. These interventions are often carried out when the opportunity arises, typically taking no more than a few minutes for basic advice.

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**Extended brief intervention:** An extended brief intervention is similar in content to a brief intervention but usually lasts more than 30 minutes and consists of an individually-focused discussion. It can involve a single session or multiple brief sessions.

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## **Search strategy**

A two-step search strategy combining an electronic search with a search in the reference lists of the studies found was carried out in August 2016 covering the time from 2000 to that date using MEDLINE(R), CINAHL, PsycINFO and EMBASE databases. The subject headings combined with Boolean search terms and free text keywords are outlined in table 2. Results were limited to human participants, articles with abstracts, and publications in English and German. Secondly, the reference lists of the selected studies were reviewed to identify eligible articles not retrieved by computer searches.

**Table 2:** Overview of search string

<b>Keywords and keywords with truncations (*)</b>	<b>Subject headings (exploded)</b>
simple advice; minimal intervention*; brief counselling; short-term counselling; brief intervention*; patient guidance; patient information; patient recommendation*; patient support	<b>MEDLINE:</b> Diabetes Mellitus; Counseling; Health Promotion; Health Education <b>CINAHL:</b> Diabetes Mellitus; Counseling; Health Promotion; Health Education <b>PsycINFO:</b> Diabetes Mellitus; Counseling; Health Promotion; Health Education; Client Education <b>EMBASE:</b> Diabetes Mellitus; Counseling; Health Promotion; Health Education; Patient information

\* indicates the use of truncation. This allows one to cover a range of versions of a word e.g. nurs\* will search for nurse, nursing and nurses.

### **Study selection**

Study selection was done by the first author (AKS) focusing on the inclusion criteria. Firstly, titles and abstracts were screened for eligibility; secondly, potential studies meeting the inclusion criteria were reviewed in full text. EndNote was used to manage the bibliographic records. Subsequently, the second author (GL) undertook an independent study selection. Thereafter, differences in study selection were discussed between AKS and GL until consensus was reached.

### **Quality appraisal**

Internal validity of the included studies was determined by the first author using the Cochrane Collaboration tool for assessing high, low or uncertain risk of bias (22).

### **Data extraction**

Data extraction was conducted by AKS using an extraction template. For each study following information was extracted: study characteristics, setting, participant characteristics, brief intervention components including the five A framework (assess, advise, agree, assist, arrange follow-up) which has been established to be a fundamental component of BI within behavioural counselling (23-25), intervention categories as classified by Sturt and colleagues (26) and intervention content as defined by the NICE guidelines (17). Further, primary and secondary outcomes as classified by Kleinpell (27) containing clinical (care-related), psychosocial, functional, fiscal, and satisfaction outcomes as well as their effectiveness in regard to the brief intervention were gathered.

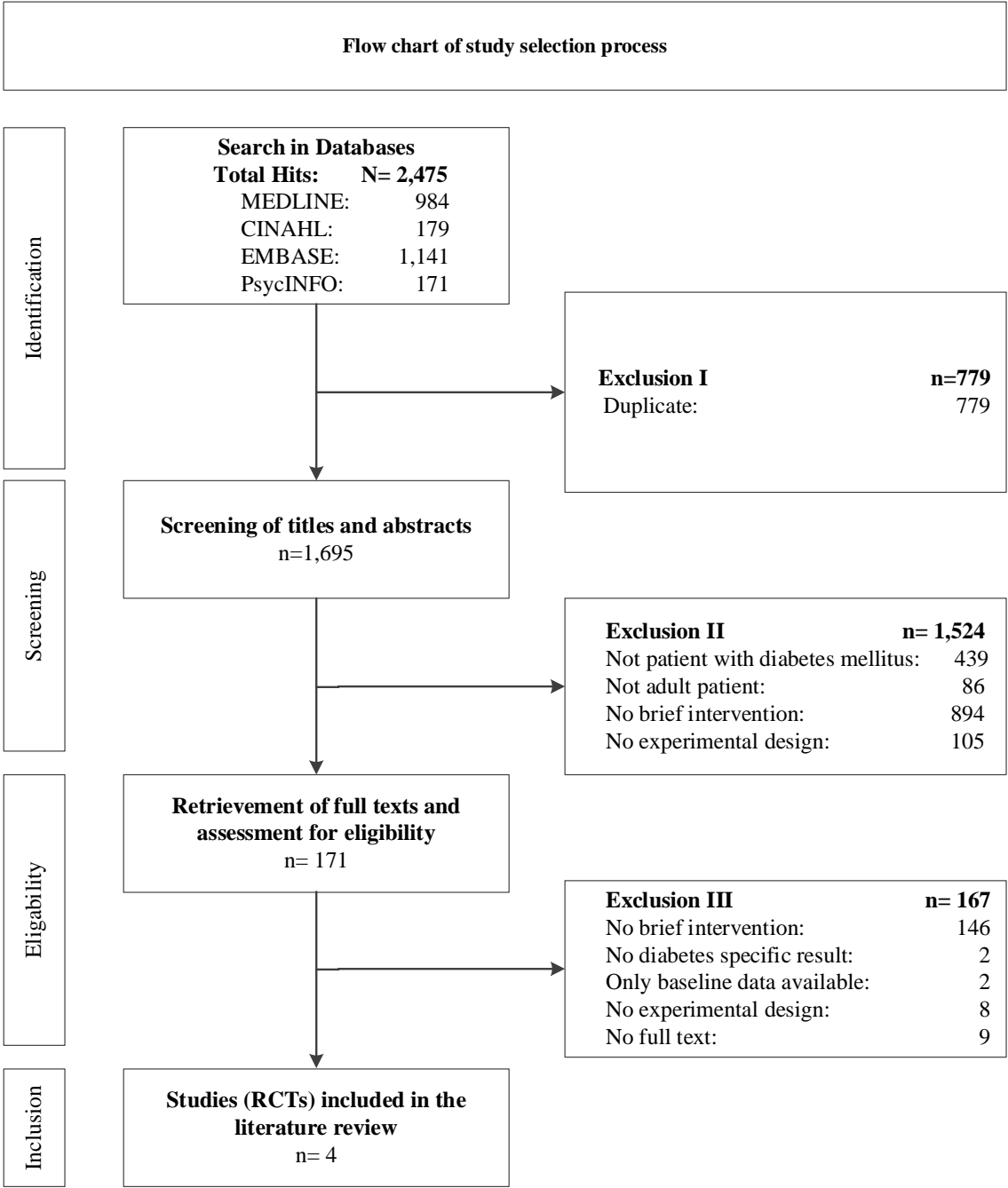


## **Data analysis**

A narrative synthesis (28) was used to analyse the findings of the various studies as a body of evidence. Based on the study aim, the characteristics, effect of BI for people with diabetes mellitus as well as the outcomes and target behaviour being studied were investigated and described.

## **RESULTS**

The literature search in the electronic databases identified 2,475 studies (figure 1). Four studies were found eligible for inclusion after removal of duplicates and papers unrelated to the literature topic. A search through the reference lists of the selected studies identified no further studies.



**Figure 1:** Flow diagram of the literature selection process.

**Study and participant characteristics**

*Setting*

Two of the included studies were conducted in Europe (UK and France) (29, 30) and two further studies were conducted in the USA (31, 32). Three articles have been published in the last decade (29, 31, 32); only one study was older than ten years (30). One study included patients (triaged as non-emergent) out of the ED (31), two studies included patients from the diabetes department (inpatient and outpatients) (29, 30) and one study included patients from the internal medical clinic (outpatients) (32). Only one of the included studies was multicentre (31).

### *Participants*

In total, 549 participants were included in this review. Study sample sizes ranged from 80 to 202 participants; three studies reported individual male and female numbers in study populations (n=336 males and n=213 females) (29-31). Three studies included only type 2 diabetes patients (29, 31, 32) and one study included type 1 as well as type 2 diabetes patients (30). Age was reported in two studies with a mean of 54.2 years (29, 30). Duration of diabetes was collected in three studies at baseline and reported with a mean of 10.8 years (29, 30, 32).

195 **Table 3:** Characteristics of included studies

First author, year, country	Study design; follow up	Population and setting sample (I/C), gender, age, setting, T1/T2	Intervention and comparison	Outcomes (results)
Borges (31), 2008, USA	RCT multicentre (three armed); baseline and 1 month.	167 (55/55 / 57), female 49%, age not reported, emergency department, T2 100%	<p><b>Brief intervention group:</b> patients received a foot self-care intervention: information about risk score and importance of daily foot self-care, barrier identification and, discussion how to overcome them. Duration 15 min.</p> <p><b>Risk assessment group:</b> patients received a foot examination, calculation of risk score, and self-testing instructions. Duration 5 min.</p> <p><b>Control group:</b> standard care.</p>	Self-reported foot self-care behaviour (measured with the Summary of diabetes Self-Care Activities): significant increase between baseline and 1 month follow up in brief intervention group ( $p<.01$ ) and control group ( $p<.05$ ), no significant difference within risk assessment group ( $p=.06$ ). No significant difference between groups ( $p=.13$ ). Observed foot self-care behaviour (measured with the Foot Self-Care Observation Guide): significant difference between groups ( $p<.05$ ).

Fall (29), 2013, France	RCT (four armed); directly after the intervention.	80 (20/20 / 20/20), female 54%, mean age 61 years, diabetes department, T2 100%	<p><b>Brief intervention groups: <i>Mastery group</i>:</b> patients were asked to recall a personal event during which they felt able to effectively control their diabetes (such as by adjusting insulin doses). <b><i>Threat group</i>:</b> patients were asked to remember a personal event when they perceived diabetes as a threat (such as at the time of diagnosis).</p> <p>Duration for each group: 15 min.</p> <p><b>Control groups: <i>Positive-emotion group (control for the mastery group)</i>:</b> patients were asked to recall a positive personal event (for example childbirth). <b><i>Negative-emotion group: (control of the threat group)</i>:</b> patients were asked to recall a negative personal event (for example conflict at their workplace).</p> <p>Duration for each group: 15 min.</p>	<p>Patients in the threat group reported less adherence (<math>p&lt;.01</math>) (measured with the medical Adherence Questionnaire) and less avoidance (<math>p&lt;.05</math>) (measured with the Acceptance and Action Diabetes Questionnaire) than those in the mastery group.</p> <p>Comparing the threat group with the matched negative-emotion group showed similar results (<math>p&lt;.05</math> and <math>p&lt;.05</math> respectively). Patients in the mastery group reported feeling a stronger sense of mastery (<math>p&lt;.05</math>) (measured with the Acceptance and Action Diabetes Questionnaire) than those in their positive-emotion control group and greater treatment acceptance than those in the threat group (<math>p&lt;.01</math>).</p>
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Kavin (32), 2010, USA	RCT (three armed). Measurement at baseline, 4 weeks, 3 and 6 months.	100 (34/33 / 33), gender and age not reported, internal medicine clinic, T2 100%	<p><b>Intervention group 1:</b> patients received a diabetes education book along with a brief nurse tutorial on it. Duration 15 – 30 minutes.</p> <p><b>Intervention group 2:</b> patients received the diabetes education book only.</p> <p><b>Control group:</b> patients received no diabetes education book, usual care.</p>	<p>A trend towards improved knowledge (measured with a self-designed knowledge questionnaire) and decreased distress (measures with the Problem Areas in Diabetes questionnaire) was detected. However, the difference between groups over three and six months was not significant. Further, a trend towards improved self-care behaviour (measures with the Summary of Diabetes Self Care Activities questionnaire) regarding adherence to diet and exercise in the intervention group compared to the control group after three and six months was observed. Unfortunately, these results were also not significant.</p>
Kidd (30), 2004, UK	RCT (five armed). Measurement at baseline, directly after the intervention and at	202 (38/42/35 / 40/47), female 44%, mean age 47 years, diabetes department, T1 43% / T2 57%	<p><b>Brief intervention groups:</b></p> <p><b>Intervention 1:</b> encouragement to ask questions. Patients were given a written message which was signed by their doctor aimed at encouraging them to ask</p>	<p>The comparison of numbers of questions asked during the encounter with the physician showed no significant differences between the intervention and control group (<math>p=.28</math> [95% CI -0.9 to 3.0]).</p> <p>Self-efficacy in asking questions (in both known and</p>

3 months.	questions. Duration: 5 min.	unknown physician) was significantly higher
	<b>Intervention 2:</b> question identification.	immediately after the consultation in the intervention
	Before their appointment with the doctor,	group compared to the control group ( $p=0.008$ [95%
	patients were helped to identify at least	CI 2.2 to 14.6] respectively $p=0.01$ [95% CI 2.5 to
	three questions that they wanted to ask of	19.0])).
	their doctor. Duration: 5 min.	Satisfaction (measured with a single item measure)
	<b>Intervention 3:</b> question identification and	directly after the consultation were not significantly
	rehearsal. Same as intervention 2, but in	different between the intervention and control group.
	addition these patients were encouraged to	After three months, the intervention group were
	rehearse their questions out loud.	significantly more satisfied compared to the control
	Duration: 5 min.	group (odds ratio [95% CI 1.33 to 4.32])).
	<b>Control groups:</b>	HbA <sub>1c</sub> over three months was not significantly
	<b>Control 1:</b> attention control group.	different between groups.
	Discussing the layout of the hospital, the	
	appointment system and routines of the	
	diabetic clinic.	
	<b>Control 2:</b> not treatment control group.	

T1, diabetes mellitus type 1; T2, diabetes mellitus type 2

## 198 **Content of brief interventions**

199 The behaviour change foci were diabetic foot care, diabetes medication adherence,  
200 acceptance and motivation, diabetes knowledge and self-care behaviour, and patients  
201 asking questions in clinical consultations.

202

203 The BI approach was stated to have taken place in all studies although none offered a  
204 definition (29-32). However, they all described core components of their BI consistent  
205 with elements described a) for brief interventions (table 1) by the NICE guidelines (17);  
206 and b) the intervention categories classified by Sturt and colleagues (26). Borges and  
207 Ostwald's (31) BI contained elements of problem-solving, and education. The  
208 components were all part of a 15-minute intervention supported by a risk assessment and  
209 pictorial forms and were accompanied by oral discussion as well as negotiation and  
210 encouragement. In Fall and colleagues study (29), mainly cognitive behavioural  
211 techniques were combined with autobiographic aspects. Their intervention lasted 15  
212 minutes and included aspects of negotiation and encouragement. The components of  
213 Kavin and colleagues (32) BI consist of a 15 to 30-minute education session supported by  
214 discussions and a researchers' self-developed educational book. And finally, Kidd and  
215 colleagues (30) held a 5-minute BI containing supportive counselling, and action  
216 planning.

217

218 Intervention components of the five A's framework (*assess, advise, agree, assist, arrange*  
219 *follow-up*) were apparent in all four studies. Three studies used the intervention  
220 component of *advice giving* (30-32) as well as *assist* (29-31) only one study used the  
221 intervention component *assess* (31), and none of the studies used the components *agree*  
222 and *arrange*. Only in the follow-up visit of Borges & Ostwald (31) beside the component  
223 advice also the component arrange was utilized.

224 The person delivering the BI remains concealed in all but one study. Kavin and  
225 colleagues (32) state the healthcare professional delivering the BI were nurses trained in  
226 diabetes care and behaviour-change techniques. Table 3 gives an overview of BI contents.



227

228 **Effects of brief interventions**

229 The reported outcomes of the interventions differed between each of the studies (table 3).  
 230 The outcomes can be classified as clinical, psychological, functional and satisfaction  
 231 using the categories of Kleinpell (27). No outcomes could be classified in the health care  
 232 economics/utilisation category and therefore the cost-effectiveness of the interventions  
 233 cannot be ascertained. Follow-up periods for data collection ranged from one follow-up  
 234 directly after the intervention (29), one follow-up after one month (31), to two follow-  
 235 ups; one after the intervention and one after three months (30), and three follow-ups after  
 236 four weeks, three and six months (32).

237

238 *Clinical outcomes*

239 Two studies assessed glycaemic control (30, 32) and found no clinical and statistical  
 240 effect on patients HbA<sub>1c</sub> over three and six months between groups (mean HbA<sub>1c</sub> in the  
 241 study by Kidd and colleagues (30) lay at 8.1 (SD  $\pm$ 1.5) in the intervention group and 8.4  
 242 (SD  $\pm$ 1.7) in the control group ( $p=.85$ ); no clinical and statistical data were presented in  
 243 the study by Kavin and colleagues (32)).

244

245 *Psychosocial outcomes*

246 Only one study assessed diabetes related distress (32) and observed decreased distress  
 247 over three and six months between groups. However, the authors report that the difference  
 248 was not statistically significant. The study by Fall and colleagues (29) evaluated  
 249 autobiographical interventions in four groups based on mastery and threat perception in  
 250 the intervention group, each having a matched control group (table 3). Patients in the  
 251 threat group reported less medical adherence ( $p<.01$ ) and less avoidance ( $p<.05$ ) than  
 252 those in the mastery group. Similar results were obtained when the threat group was  
 253 compared with its matched negative-emotion control group (both  $p<.05$ ). Patients in the  
 254 mastery group reported feeling a stronger sense of mastery ( $p<.05$ ) than those in their  
 255 positive-emotion control group and greater treatment acceptance than those in the threat

group ( $p<.01$ ) directly after the intervention. The measurement of participants' diabetes perception remained non-significant between the groups. Borges and Ostwald (31) measured diabetes self-efficacy one month after their foot self-care intervention and could not detect a significant difference between groups. In the study of Kidd and colleagues (30) however, levels of self-efficacy was significantly higher immediately after the consultation in the intervention group compared to the control group ( $p=0.008$  [95% CI 2.2 to 14.6] respectively  $p=0.01$  [95% CI 2.5 to 19.0]). The effect was not apparent after three months. And finally, the measurement of foot self-care knowledge after one month (31) and diabetes knowledge after three and six months (32) did not show a significant difference between the intervention and control groups.

#### *Functional outcomes*

The study by Kavin and colleagues (32) illustrated a trend towards an improved self-care behaviour regarding adherence to diet and exercise in the intervention group compared to the control group at three and six-month follow-up. No statistical data were reported, however, comparing the change over six months' time in those who received a diabetes education book with those who did not, showed an improvement in diet scores ( $p=.034$ ) and exercise scores ( $p=0.010$ ). In the study conducted by Kidd and colleagues (30), the number of questions asked during the encounter with the physician was counted and compared between the intervention and the control group. This formal test revealed no significant difference between the two groups ( $p=.28$  [95% CI -0.9 to 3.0]). The study of Borges and Ostwald (31) showed a significant difference in the self-reported foot self-care behaviour within the intervention ( $t(47)=-4.32$ ,  $p<.01$ ) and control group ( $t(46)=-2.06$ ,  $p<.05$ ) between baseline and one month follow-up. Nonetheless, there was no significant difference between the groups ( $F(2,140)=2.06$ ,  $p=.13$ ) at follow-up. Also foot care performance showed significant differences between groups in 4 items (applying lotion between toes ( $2, N=142=9.38$ ,  $p<.01$ ); checking the bottom of the foot ( $2, N=142=6.35$ ,  $p<.05$ ); not walking barefoot ( $1, n=97=7.58$ ,  $p<.016$ ); and using sharp instruments ( $2, N=142=6.63$ ,  $p<.05$ ) after one month (31).

## 285 *Satisfaction*

286 Lastly, the outcome category satisfaction was evaluated solely by Kidd and colleagues  
 287 (30) with a logistic regression analysis. Satisfaction with the consultation measured after  
 288 three months was statistically significant between the groups with an odds ratio of 2.39  
 289 (95% CI; 1.33-4.32) in favour for the intervention group.

290

## 291 **Risk of bias in included studies**

292 “High risk” was determined for any of the three domains: randomisation sequence,  
 293 allocation concealment and blinding outcome assessment, as being at “high risk of bias”  
 294 (see Figure 2). One study (30) was regarded at being at “low risk of bias” for the three  
 295 key domains. The remaining three studies were rated unclear for one or more key  
 296 domains and an unclear risk of bias assessment was made.

297

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Borges 2008	?	?	—	+	—	?	+
Fall 2013	?	?	+	+	?	+	?
Kavin 2010	+	?	?	+	—	—	?
Kidd 2004	+	+	+	+	?	+	+

298

299 **Figure 2:** “Risk of bias” summary: review author’s judgment about each risk of bias item  
 300 for each included study.

301

302

## **DISCUSSION**

### **Summary of evidence**

This systematic review revealed only four RCT studies using BI for adult people with diabetes since the year 2000. The review summarized and described the components of BI, and their effects on people with diabetes. The study quality was assessed by the critical judgment of “risk of bias”. The main problem identified was the incomplete reporting of outcome data.

All four studies focused on different behavioural interventions. While all the interventions were of short duration, the components of the interventions varied. Education was the most reported intervention, followed by cognitive behavioural technique, problem solving and supportive counselling. Oral discussions as well as negotiations and encouragement seem to be other relevant aspects of BI and demonstrate that the interventions categories classified by Sturt and colleagues (26) as well as the NICE guidelines (17) definition of BI were valid forms of classification. As the NICE guidelines definition recommends, *advice* along with *assist* were the most utilized components out of the five A framework. The framework has been proven to be theoretical as well as empirical valid in smoking cessation or high risk drinking and has been identified as one of the key steps in chronic illness self-management as for instance in diabetes (24, 33, 34)

The most striking feature of this literature review is the lack of evidence related to BI in diabetes and especially in the brief opportunistic environments of ED where people with diabetes attend frequently. Even though BIs indicated evidence to improve functional and psychosocial outcomes (29, 31), there was insufficient evidence to support an effect of BI on the other four outcomes also categorised as functional and psychosocial outcomes besides clinical outcomes (30, 32). The reasons could be due to limitations in the design or the occurrence of the Hawthorne effect (31). Further limitations may be discussed in conjunction with the interventions content. DSME and DSMS are essential elements in current diabetes care and have shown to improve self-management, satisfaction as well as

functional outcomes such as HbA<sub>1c</sub> (35-37). But without maintaining a patient centred approach, an active collaboration with the healthcare team cannot be sustained. Further, the development of the BI was not illustrated in three studies and some of the studies did not state who delivered the BI and what their training had been previously. Additionally, the suggested components capability, opportunity and especially motivation relating to the COM-B model (8) were not taken into consideration when developing and conducting the BI. This may be a strong indicator of the low evidence as seen in the included studies. Finally, no informal care givers such as family members or friend were included in the interventions. Along with patients' motivation to enhance their health related outcomes, informal care givers are an important support, especially in caring for people with chronic conditions extensive unmet needs for information and emotional support on behalf of the informal care givers have to be resolved (38) and the patient and informal caregiver along with the healthcare professionals need to be seen as a team.

345

#### 346 **Strengths and limitation of the review**

347 This was the first systematic review aimed at identifying effective BI for people with  
348 diabetes especially for those attending the ED frequently. A specific search strategy was  
349 designed and a rigorous approach to the literature search and critical appraisal was  
350 followed.

351 A challenge featured the operationalisation of BI definition using the NICE guideline  
352 (17). As the proposed definition is brief itself, a process of clarification and reflection  
353 throughout the study selection process had to be applied. The utilization of the  
354 intervention (26) and the outcome categories (27) showed to be a valid way of  
355 categorization.

356 The quality of studies included in this review varied from moderate to low. No studies  
357 were evaluated to be of high quality due to risk of bias. Removing low quality studies  
358 would have caused an incomplete description of the components used in this review.  
359 However, BI is an often described intervention for different behaviour changes and only  
360 four databases were searched and studies published only in English and German were

selected. Relevant studies published in other languages and indexed in different databases could have been missed. Also unpublished studies were not considered. The included studies describe BI for patients with type 1 and 2 diabetes. To further describe BI characteristics and their effects on people with diabetes type 1 and 2, studies excluded in this review (such as studies including patients with gestational diabetes or patients with impaired glucose tolerance) could be reviewed separately.

### **Implication for practice and research**

BIs have shown to be successful in different settings and populations as well partly in people with diabetes (14, 29-32). Healthcare professionals need to be aware of the evidence in their practice field. In order to be able to administer BI as part of DSME and DSMS, healthcare professionals and particularly those in ED, need to acquire and maintain knowledge, skills and ability to perform BI when the opportunity arises. It therefore is relevant to understand what the current practice comprises of and to identify healthcare professionals' attitudes, beliefs and, possible barriers and facilitators to promote BI. People with diabetes have many and multiple contacts with healthcare professionals, ranging for example from prescription collection in pharmacies to eye screeners to nurses at their annual reviews. These encounters facilitate many opportunities to use every opportunity to deliver BI. The main aim of the BI is to enhance the patient's motivation for a behaviour change. Guidelines like *Making Every Contact Count* can be helpful to establish systematic changes towards helping people make healthier choices and to achieve positive long-term behaviour changes (39).

## **CONCLUSION**

Future research needs to be conducted in order to further investigate the effectiveness of BI for patient with diabetes. Studies with longitudinal design are needed to determine the effectiveness of such interventions. Further, studies containing health economic outcomes should be incorporated. ED is an environment that was set up for acute and urgent presentations. A recent study by Elwen and colleagues (40) investigated the main

390 characteristics of diabetes patients with hypoglycaemia requiring emergency service  
 391 interventions over a period of eight years. Among 1156 patients, 1835 episodes of  
 392 hypoglycaemia were registered. The study showed that severe hypoglycaemia was  
 393 common with male and predominantly in type 1 diabetes and was a common feature in  
 394 the ED setting. Yet, there is currently no evidence to inform ED healthcare professionals  
 395 how to treat the whole person beyond saving their life in the immediate way. This is in  
 396 contrast with other clinical scenarios encountered commonly in the ED as for instance  
 397 alcohol related presentations, where interventions exist and are delivered (14, 15).  
 398 Patients treated in the ED may have a high intrinsic motivation to change their behaviour  
 399 in favour of a healthy living and to avoid further ED attendance. However, special  
 400 attention has to be applied to those patients with an impaired awareness as in patients  
 401 with hypoglycaemia unawareness. Therefore, this setting may be prioritised for further  
 402 research and ED staff needs to be educated and trained to perform BI in this setting. In  
 403 order to further examine BI in the population with diabetes, further literature review  
 404 including patients with gestational diabetes or impaired glucose tolerance may be helpful.  
 405 Moreover, studies including children and adolescents with diabetes could give an in-sight  
 406 inside into BI including their parents. It is concluded, that BI involve different  
 407 components and can therefore be described as a complex intervention (41). These have to  
 408 be further investigated using a systematic approach. Furthermore, the absence of evidence  
 409 to inform ED clinical decision-making following treatment of severe hypoglycaemic is  
 410 striking. Without evidence to inform their practice, ED clinicians cannot offer evidence  
 411 based and person-centred care.

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